Stoller
Hanford Office

HGLP-LDR-004

299-W18-180 (A7662)
Log Data Report

Borehole Information:

Borehole:	299-W18-180 (A7662)		Site:	216-Z-12 Crib	
Coordinates (WA St Plane)		GWL[1] (ft)	None	GWL Date:	02/08/06
North (m)	East (m)	Drill Date	Ground Level Elevation	Total Depth (ft)	Type Cable
135458.685	566357.13	06/80	686.73	40.0	

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Steel	2.1	6 5/8	6 1/16	5/16	+2.1	40

Borehole Notes:

The logging engineer measured the casing stick-up and diameter using a caliper and steel tape. Logging data acquisition is referenced to the TOC. Grout is reported in the bottom of the casing from 40 to 42 ft and in the annular space outside the 6-in. casing from 0 to 17 ft.

Logging Equipment Information:

Logging System:	Gamma 4N		Type:	SGLS (60%) SN: 45TP22010A
Effective Calibration Date:	08/16/05	**Calibration Reference:**	DOE-EM/GJ953-2005	
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0	

Logging System:	Gamma 4I		Type:	Passive Neutron U1754
Calibration Date:	None	Calibration Reference:	None	
Calibration not required		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3 Repeat		
Date	01/05/06	01/06/06	01/06/06		
Logging Engineer	Spatz	Spatz	Spatz		
Start Depth (ft)	40.0	23.0	25.0		
Finish Depth (ft)	22.0	3.0	25.0		
Count Time (sec)	200	200	1000		
Live/Real	R	R	R		
Shield (Y/N)	N	N	N		
MSA Interval (ft)	1.0	1.0	1.0		
ft/min	N/A[2]	N/A	N/A		
Pre-Verification	DN081CAB	DN101CAB	DN101CAB		
Start File	DN091000	DN101000	DN101021		
Finish File	DN091018	DN101020	DN101021		

Log Run	1	2	3 Repeat		
Post-Verification	DN091CAA	DN101CAA	DN101CAA		
Depth Return Error (in.)	0	0	0		
Comments	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.		

Passive Neutron Logging System (PNLS) Log Run Information:

Log Run	4	5 Repeat			
Date	01/06/06	01/06/06			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	40.0	31.0			
Finish Depth (ft)	3.0	23.0			
Count Time (sec)	N/A	N/A			
Live/Real	R	R			
Shield (Y/N)	N	N			
Sample Interval (ft)	1.0	1.0			
Log speed (ft/min)	1.0	1.0			
Pre-Verification	DI282CAB	DI282CAB			
Start File	DI282000	DI282038			
Finish File	DI282037	DI282046			
Post-Verification	DI282CAA	DI282CAA			
Depth Return Error (in.)	0	0			
Comments	None	None			

Logging Operation Notes:

Logging was conducted with a centralizer on the sonde and measurements are referenced to top of casing. Repeat data were acquired at 1000 second counting time at 25.0 ft to provide additional detail of the highest activity zone.

Passive neutron logging was also performed in the borehole. This logging method has been shown to be effective in qualitatively detecting zones of alpha-emitting contaminants from secondary neutron flux generated by the (α,n) reaction and may indicate the presence of transuranic radionuclides.

Analysis Notes:

Analyst:	Henwood	Date:	09/20/06	Reference:	GJO-HGLP 1.6.3, Rev. 0

Pre-run and post-run verifications for the SGLS were performed before and after each day's data acquisition. The acceptance criteria were met.

An AmBe neutron source was used for verification measurements with the passive neutron logging system. Currently there are no verification criteria established for this system. The counts obtained from the pre and post verifications were within 1 percent.

A casing correction for 5/16-in.-thick casing was applied throughout the borehole.

SGLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with an EXCEL worksheet template identified as G4NAug05.xls using an efficiency function and corrections for casing and dead time as determined from annual calibrations.

Results and Interpretations:

^{237}Np is detected with the SGLS by measuring a daughter product (protactinium-233 (^{233}Pa)) that emits relatively prominent gamma rays at energy peaks of 300.34, 312.17, 340.81, 375.45, 398.62, and 415.76 keV. The 312.17 keV gamma line exhibits the highest yield (38.6 %) and is used to determine the concentration for ^{233}Pa. ^{233}Pa was detected between 23 and 33 ft. The maximum concentration is 11 pCi/g at 25 ft in depth.

A slightly elevated ^{232}Th concentration as determined using the 2615 keV (208Tl) energy peak, is indicated at 25 ft where data were acquired for a 1000 second counting time. The plot of natural gamma logs shows the disruption of the equilibrium of the natural ^{232}Th decay, where at 25 ft the ^{228}Ac indicates ^{232}Th concentrations below that calculated from the 2615 keV gamma line. This difference is attributed to the existence of ^{232}U. To determine the concentration of ^{232}U, the activity due to natural decay of ^{232}Th must be subtracted. The ^{228}Ac concentration is subtracted from the ^{232}Th concentration calculated based on the 2615 keV 208Tl energy peak. The result is a maximum concentration of approximately 0.2 pCi/g ^{232}U. Given the total error of the measurements, this difference may not be statistically significant at this borehole. However, data from nearby boreholes exhibit the same characteristic where the determination of ^{232}U is more definitive and occurs at approximately the same depth.

^{233}U almost certainly exists where ^{232}U is detected. In a reactor using thorium target material, ^{233}U will be generated at two to three orders of magnitude more than ^{232}U. However, at relatively low concentrations, ^{233}U and its decay products emit few gamma rays that can be detected with the SGLS. Decay products that potentially could be measured, have not had sufficient time to grow into equilibrium with their parent so that detection is possible. It is inferred on the basis of the probable ^{232}U concentration that less than 200 pCi/g ^{233}U may exist in this waste stream.

The passive neutron log data indicate no significant neutron flux that would suggest the existence of high concentrations of transuranics.

Soil samples were acquired in this borehole during an investigation of the 216-Z-12 Crib in 1982 (Kasper, 1982). At approximately 25 ft in depth (subtracting for casing stickup) laboratory analyses indicated ^{239}Pu and 241Am at concentrations of approximately 12 and 2 pCi/g, respectively. The limits of detection using the SGLS in steel casing is 3 orders of magnitude more than the laboratory results and these radionuclides were not detected. The Kasper investigation apparently did not analyze for other contaminants such as ^{237}Np and ^{232}/^{233}U that were observed using the SGLS.

Spectral gamma data were acquired in this borehole in 1993 by Westinghouse Hanford Company using the Radionuclide Logging System (RLS). A comparison plot of the RLS (1993) and SGLS (2006) manmade radionuclides show similar concentrations for ^{233}Pa. Data analysis for the 1993 data did not identify ^{232}U or ^{233}U as potential contaminants.

References:

Kasper, R.B., 1982. 216-Z-12 Transuranic Crib Characterization: Operational History and Distribution of Plutonium and Americium, RHO-ST-44, Rockwell International, Richland, Washington.

List of Log Plots:

Man-Made Radionuclide Plot
Natural Gamma Logs
Combination Plot
Total Gamma, Passive Neutron & Dead Time
SGLS/RLS Manmade Comparison Plot

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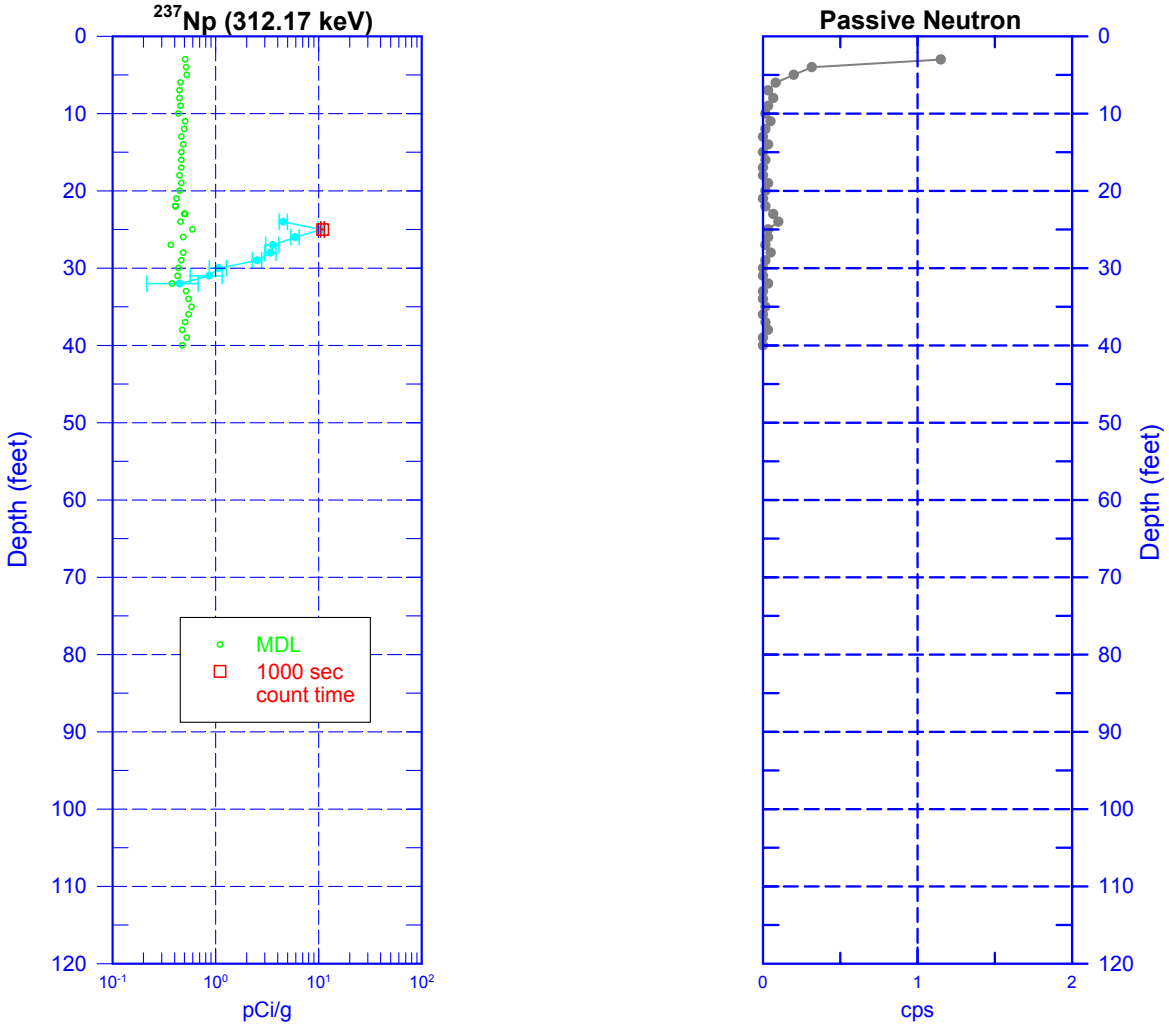
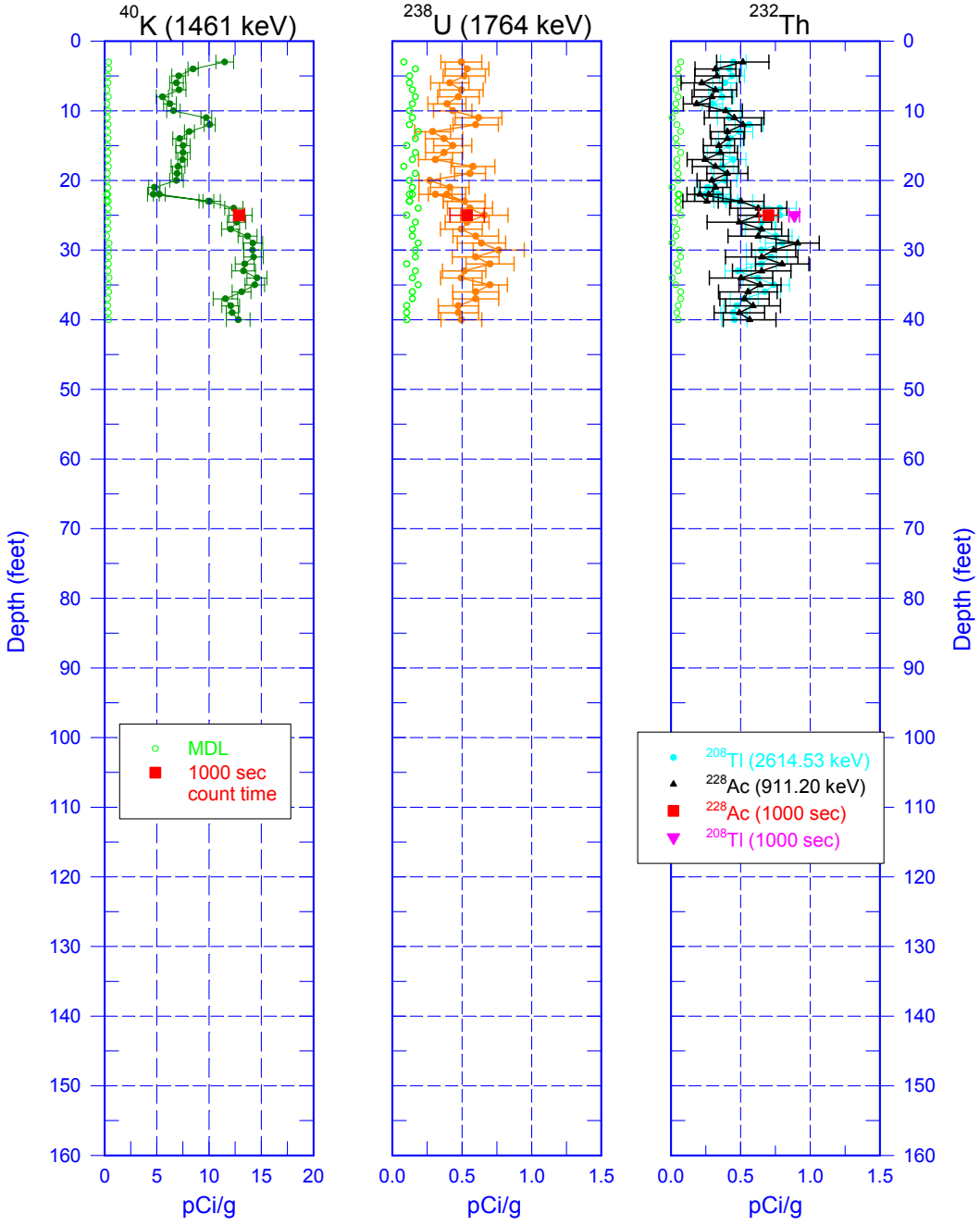
[11] GWL – groundwater level
[2] N/A – not applicable

299-W18-180 (A7662) Manmade Radionuclide Plot



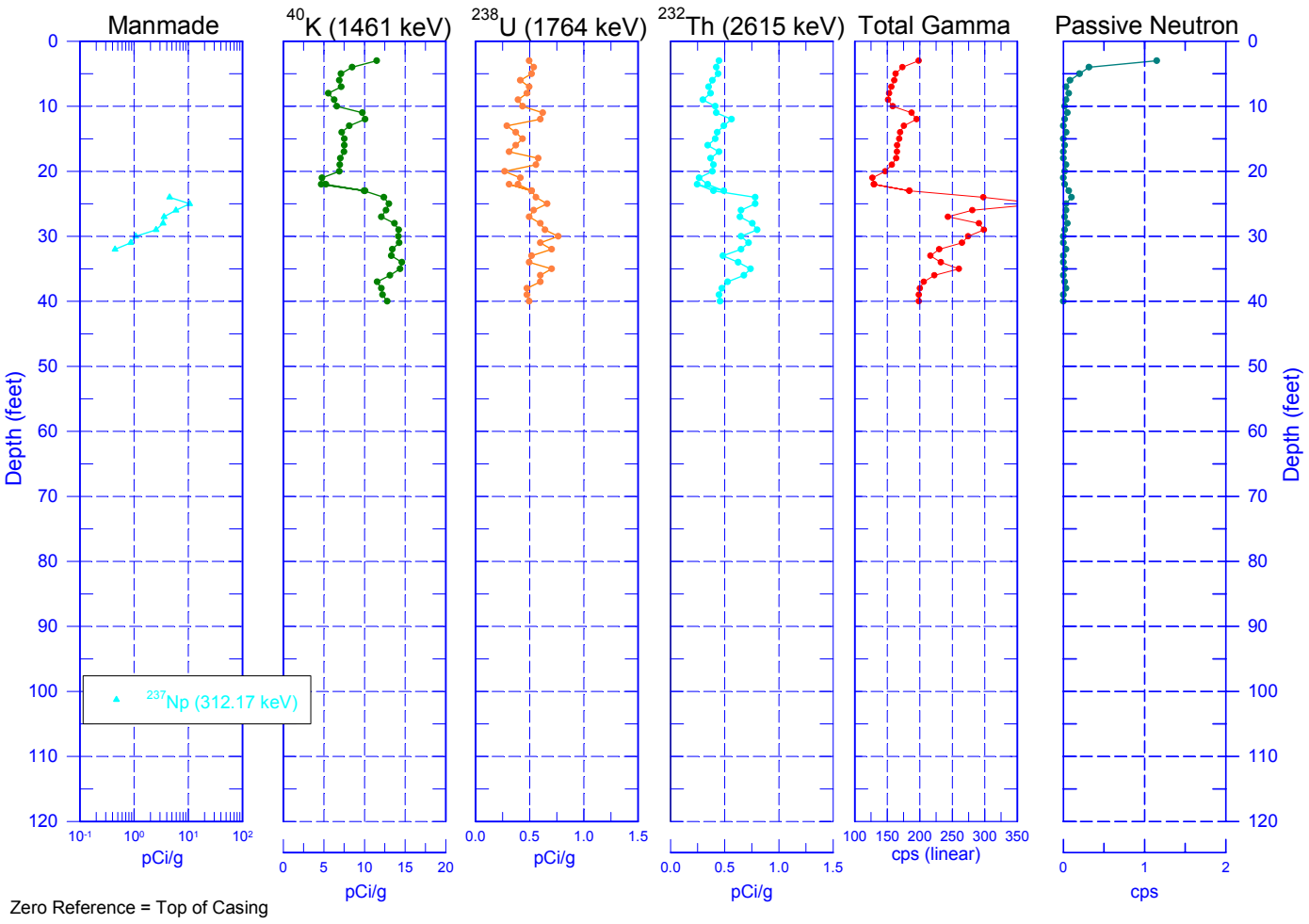
Zero Reference = Top of Casing

299-W18-180 (A7662)
Natural Gamma Logs

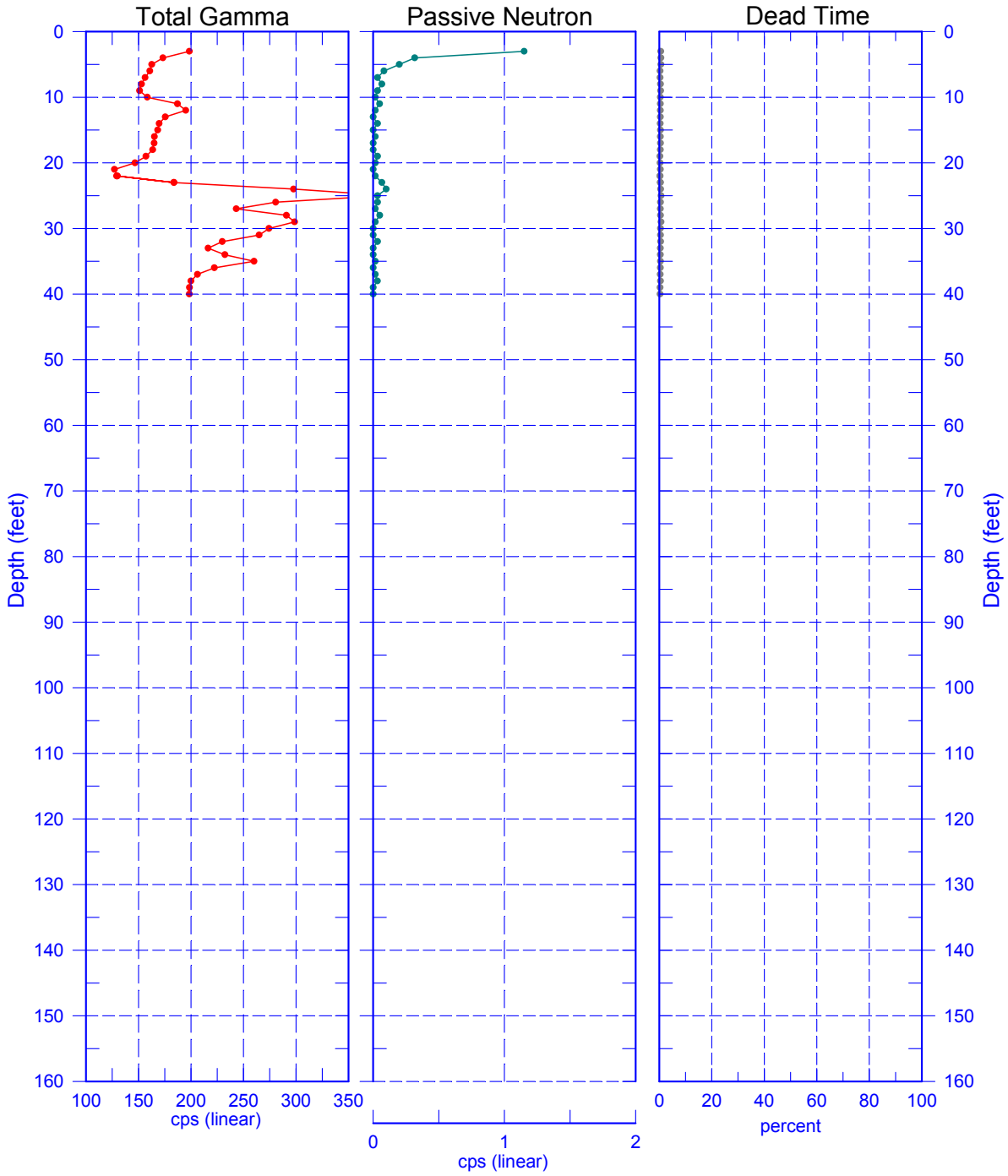


Zero Reference = Top of Casing

299-W18-180 (A7662) Combination Plot

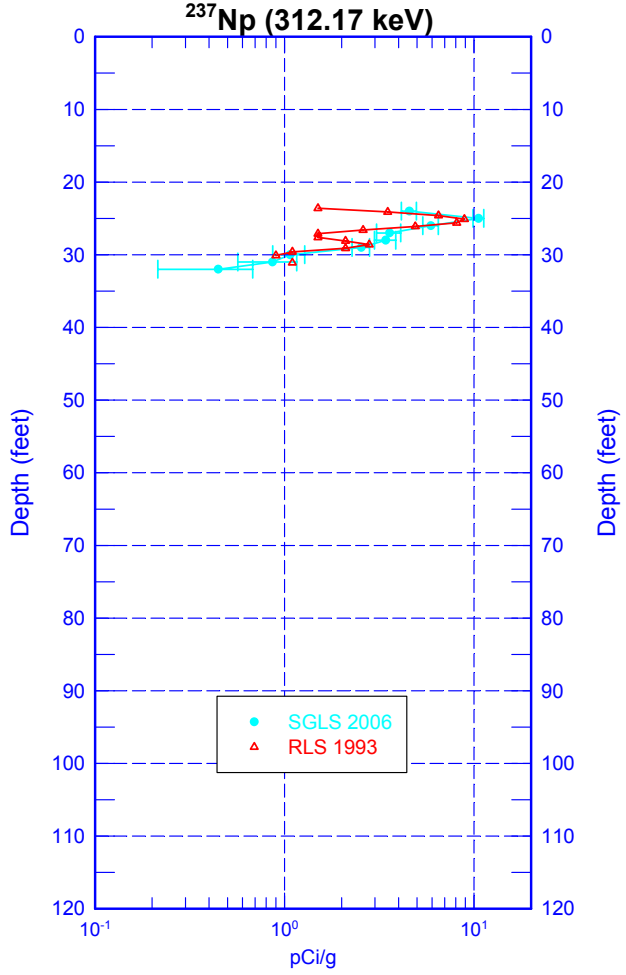


299-W18-180 (A7662)
Total Gamma, Passive Neutron & Dead Time



Reference - Top of Casing

299-W18-180 (A7662) SGLS/RLS Manmade Comparison Plot



Zero Reference = Top of Casing